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**REISSUE APPLICATION FEE TRANSMITTAL FORM**

Docket Number (Optional)

042390.P3581R

## Claims as Filed - Part 1

Claims in Patent		Number Filed in Reissue Application	(3) Number Extra	Small Entity Rate	Fee	Other than a Small Entity Rate	Fee
(A)	Total Claims (37 CFR 1.16(j))	(B) 11	**** =	x \$9.00 =		x \$18.00 =	0.00
(C)	Independent Claims (37 CFR 1.16(i))	(D) 4	* 4 =	x \$40.00 =		x \$80.00 =	320.00
Basic Fee (37 CFR 1.16(h))							\$355.00
Total Filing Fee						OR	\$710.00
							\$1,030.00

## Claims as Amended - Part 2

	(1) Claims Remaining After Amendment		(2) Highest Number Previously Paid For	(3) Extra Claims Present	Small Entity Rate	Fee	Other than a Small Entity Rate	Fee
Total Claims (37 CFR 1.16(j))	*** 11	MINUS ** 20	* =	x \$9.00 =		x \$18.00 =	0.00	
Independent Claims (37 CFR 1.16(i))	*** 4	MINUS ***** 3	1 =	x \$40.00 =		x \$80.00 =	18.00	
Total Additional Fee						OR	\$18.00	

\* If the entry in (D) is less than the entry in (C), Write "0" in column 3.

\*\* If the "Highest Number of Total Claims Previously Paid For" is less than 20, Write "20" in this space.

\*\*\* After any cancellation of claims.

\*\*\*\* If "A" is greater than 20, use (B - A); if "A" is 20 or less, use (B - 20).

\*\*\*\*\* "Highest Number of Independent Claims Previously Paid For" or Number of Independent Claims in Patent (C).

☐ Applicant claims small entity status. See 37 CFR 1.27.☐ Please charge Deposit Account No. 02-2666 in the amount of \_\_\_\_\_.  
A duplicate copy of this sheet is enclosed.☒ The Commissioner is hereby authorized to charge any additional fees under 37 CFR 1.16 or 1.17 which may be required, or credit any overpayment to Deposit Account No. 02-2666.  
A duplicate copy of this sheet is enclosed.☒ A check in the amount of 1030.00 to cover the filing / additional fee is enclosed.☐ Payment by credit card. Form PTO-2038 is attached.**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2039.**

November 22, 2000

Date

Signature of Applicant, Attorney or Agent of Record

Donna Jo Coningsby

Typed or printed name

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Reissue Application No.: Not Yet Assigned

Filed: Concurrently herewith

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Patent No.: 5,841,431

Granted:

Patentee: Charles Russel Simmers

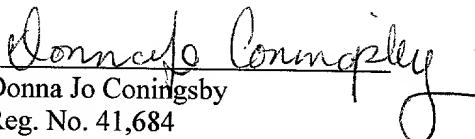
Title: APPLICATION OF SPLIT- AND DUAL- SCREEN LCD  
PANEL DESIGN IN CELLULAR PHONES

**Commissioner of Patents  
and Trademarks  
Washington, D.C. 20231**

**REQUEST FOR ABSTRACT OF TITLE**

1. Please prepare a certified Abstract of Title in respect of the above identified original patent for placing in the official file of the Reissue Application which is filed herewith.
2. Title in the name of INTEL CORPORATION  
was recorded on 11/15/1996, Reel 8315, Frame 0246.

Date: November 22, 2000

  
Donna Jo Coningsby  
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Los Angeles, California 90025-1026  
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PATENT APPLICATION

042390.P3581R

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: ) November 24, 2000  
)  
Charles R. Simmers )  
)  
Original Patent Number: 5,841,431 ) Group Art Unit: unknown  
)  
Issued: November 24, 1998 ) Examiner: S. Saras

For: APPLICATION OF SPLIT- AND DUAL-SCREEN LCD PANEL DESIGNS IN  
CELLULAR PHONES

EL034435633US

"Express Mail" Label Number

November 22, 2000

Date of Deposit

I HEREBY CERTIFY THAT THE ENCLOSED PETITION IS BEING DEPOSITED WITH  
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DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE,  
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Mark Baugher

Name of Person Mailing Paper or Fee

[Signature]  
Signature

PRELIMINARY AMENDMENT FOR REISSUE APPLICATION, OFFER TO  
SURRENDER THE ORIGINAL PATENT, AND ASSENT OF ASSIGNEE TO REISSUE

HONORABLE DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE,  
Washington, D.C. 20231

SIR:

In accordance with 35 U.S.C. § 251, Applicant is hereby filing a reissue  
application with claims that are broader than those issued in the original patent.

Please enter the following amendment prior to examination so that there is a  
total of eight (8) independent and a total of thirty-two (32) claims pending in the  
application. Claims 1-11 of the original patent remain in the application.

**PATENT APPLICATION**

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**AMENDMENT**

**Amendment to Claims**

Please add the following claims as shown below.

12. (Newly added) An apparatus comprising:  
a wireless communication module;  
a computing module;  
a display, wherein the display is adapted to display information related to the wireless communication module and the computing module; and  
a display controller adapted to disable a first portion of the display and enable a second portion of the display.
13. (Newly added) The apparatus of claim 12, wherein the first portion of the display is adapted to display information related to the wireless communication module.
14. (Newly added) The apparatus of claim 13, wherein the second portion of the display is adapted to display information related to the computing module.
15. (Newly added) The apparatus of claim 13, wherein the first portion is adapted to display information related only to the wireless communication module.
16. (Newly added) The apparatus of claim 12, wherein the computing module is adapted to operate as a personal digital assistant.
17. (Newly added) The apparatus of claim 12, further comprising at least two segment drivers coupled to the display and the controller.
18. (Newly added) The apparatus of claim 12, wherein the display controller is adapted to disable the first portion of the display while the second portion of the display is enabled.

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✓ 19. (Newly added) An apparatus comprising:

a display controller adapted to disable a first portion of a display while enabling a second portion of a display, the first portion of the display adapted to display information from a wireless communication device and the second portion of the display adapted to display information from a personal digital assistant.

20. (Newly added) The apparatus of claim 19, wherein the display controller is further adapted to enable the first portion of the display while disabling the second portion of the display.

21. (Newly added) The apparatus of claim 19, further comprising at least two segment drivers coupled to the display and the display controller.

22. (Newly added) The apparatus of claim 19, wherein the first portion of the display is physically contiguous with the second portion of the display.

23. (Newly added) The apparatus of claim 19, wherein the first portion of the display is physically separated from the second portion of the display.

✓ 24. (Newly added) A method comprising:

displaying information related to a wireless communication device on a first portion of a display;

disabling the first portion of the display; and

displaying information related to a personal digital assistant on a second portion of the display.

25. (Newly added) The method of claim 24, wherein disabling the first portion of the display occurs substantially simultaneously with displaying information on the second portion of the display.

26. (Newly added) The method of claim 24, further comprising displaying information related to the wireless communication device after disabling the second portion of the display.

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27. (Newly added) The method of claim 24, further comprising displaying information related to the wireless communication device substantially simultaneously with displaying information related to the personal digital assistant on the second portion of the display.

✓ 28. (Newly added) An article comprising:

a storage medium having stored thereon instructions, that, when executed by a computing platform, results in:

displaying information on a first portion of a display, wherein the information is related to a wireless communication module;

displaying information on a second portion of a display, wherein the information is related to an application program running on the computing platform; and

disabling the first portion of the display while displaying information on the second portion of the display.

29. (Newly added) The article of claim 28, wherein the instructions, when executed, further result in disabling the second portion of the display with a display controller.

30. (Newly added) The article of claim 28, wherein the instructions, when executed, further result in disabling a first segment driver and disabling a second segment driver.

31. (Newly added) The article of claim 28, wherein the instructions, when executed, further result in disabling the second portion of the display while displaying information on the first portion of the display.

32. (Newly added) The article of claim 28, wherein the instructions, when executed, further result in substantially simultaneously displaying information on the first portion of the display and the second portion of the display.

**PATENT APPLICATION**

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**Remarks**

Applicant hereby requests that United States Patent and Trademark Office initiate broadening reissue proceedings for the above-mentioned issued patent. Applicant requests that the preceding claims be added prior to examination.

**Specification**

A copy of the original patent is filed concurrently with this as it was filed on November 15, 1996. In addition, the text of the enclosed application has been modified, as required by 37 CFR § 1.173, to reflect the changes made by the amendment filed on January 30, 1998. These amendments have been shown as normal text as they appear in the original patent. No new matter has been added.

**Oath and Declaration**

Applicant has filed concurrently with this reissue application an oath and declaration that is believed to meet the requirements of 37 CFR §1.175.

**Offer to Surrender the Original Patent**

Patent No. 5,84,431 granted to Charles R. Simmers on November 24, 1998 of which Intel Corporation, now sole owner by assignment, and on whose behalf and with whose assent the accompanying application is made, hereby offers to surrender said letter patent.

**Assent of Assignee to Reissue**

The undersigned assignee hereby avers in accordance with 37 CFR §3.73 that he is authorized to act on behalf of the assignee of the entire interest in the above-mentioned letters patent and hereby assents to the accompanying application.

**Drawings for the Reissue Application**

In accordance with M.P.E.P. §1413, Applicant hereby requests transfer of the drawings from the file of the original patent in lieu of new drawings. Applicant is enclosing with this reissue application a photocopy of the drawings of the patent as temporary drawings as permitted by 37 CFR § 1.174.



PATENT APPLICATION

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**Request for Abstract of Title Report**

Applicant is filing herewith a request for a certified Abstract of Title report and appropriate fee in accordance with 37 CFR § 1.171.

**Support for Amendments.**

As indicated above, claims 12-32 have been added. Support for the amendments is at least shown by the examples in FIG. 2 and 4 and described in Applicant's specification. Support for the amendments can also be found in claims 1-11 of the original patent.

Applicant respectfully submits that no new matter has been added.

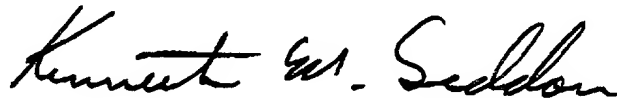
**Conclusion**

Applicant respectfully requests that the Examiner allow all pending claims.

Should it be determined that an additional fee is due under 37 CFR §§1.16 or 1.17, or any excess fee has been received, please charge that fee or credit the amount of overcharge to deposit account #02-2666.

If the Examiner believes that there are any informalities which can be corrected by an Examiner's amendment, a telephone call to the undersigned at (480) 554-9732 is respectfully solicited.

Respectfully submitted,  
Charles Simmers



Kenneth M. Seddon  
Patent Attorney  
Reg. No. 43,105

Dated: 11-20-00

c/o Blakely, Sokoloff, Taylor & Zafman, LLP  
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UNITED STATES PATENT APPLICATION

FOR

APPLICATION OF SPLIT- AND DUAL-SCREEN  
LCD PANEL DESIGN IN CELLULAR PHONES

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EL034435633US

## BACKGROUND OF THE INVENTION

### Field of the Invention

The present invention relates to the field of display devices. More specifically, the present invention relates to graphical displays connected to information devices.

### Description of Related Art

In high-end "smart" cellular phones, which function both for telecommunications and for storing and retrieving information (e.g., a Personal Digital Assistant (information device)), it is often necessary to provide two displays, one for each function. The smaller of the displays, used for the telecommunications function, commonly consists of between ten and twenty characters across (columns) and three to eight rows. The larger of the displays, used for the information device function, is a graphical display with a resolution of typically 640 pixel columns across by 240 pixel rows.

Traditionally, each display was treated as a separate system since the smaller display operates continuously, while the larger display operates more sparingly. In periods of non-use, the large display is powered-down. Disadvantageously, each display has its own controller to convert information into displayable pixels and its own integrated circuits which drive the pixels to be output on the display panels. In battery-operated and power-conscious devices such as PDAs, the redundancy of having two sets of drivers, integrated circuits and

1  
controllers is expensive and can also increase the mean-time-between-failure for the devices. Further, where a single display is used for both functions, the entire display must be active, even when only a small sub-panel of the display is required to  
5 operate (i.e., for telecommunications). In such a circumstance, the power drain is excessive for the function served, and, therefore, highly inefficient.

Thus, there is a need to reduce the power drain of such devices by allowing independent operation of only one display, in  
10 the case of two separate displays, and a sub-panel in the case of single physical display.

## SUMMARY

In the case of some dual-function information devices such as a cellular phone with PDA, two separate physical displays are controlled by a single video controller. The video  
5 controller provides a plurality of control signals to drivers which drive pixels onto the displays. The invention provides a power control block which is coupled to those drivers to selectively power-down drivers for the larger of the two displays, while keeping powered-up the smaller of the displays.  
10 The power control block can be programmed by a user/software to power-up or power down the displays as dictated by the use of the Information device. The power control block is, therefore, coupled to a CPU or other such processor from which it receives commands regarding which display to keep powered-up and which to  
15 power down.

Alternatively, in dual-function information devices where there is only one physical display for the information device, a similar power control block can be programmed by  
instructions being entered by the CPU to selectively power-down  
20 certain pixel drivers for the display and thereby create a logical "sub-panel". A single display screen may be split into two or more logical sub-panels, each of which has corresponding drivers which output pixels to their portion of the display, and are independently powered-up or down as the application requires.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**Figure 1** is an operational diagram of a typical LCD display according to the prior art.

**Figure 2** is an operational diagram of a split screen LCD display according to one embodiment of the invention.

**Figure 3** is an illustration of how a split screen LCD display may be utilized in a information device.

**Figure 4** is an operational diagram of a dual screen LCD display according to one embodiment of the invention.

**Figure 5** is a system diagram of a computer system with a dual LCD panel display system according to one embodiment of the invention.

**Figure 6** is a system diagram of a computer system with a split-screen LCD panel according to one embodiment of the invention.

## DETAILED DESCRIPTION OF THE DRAWINGS

**Figure 1** is an operational diagram of a typical LCD display according to the prior art.

**Figure 1** shows a 640 by 240 dot-matrix liquid crystal display (LCD) panel 100 which is driven by two inputs 1100 and 1150 for rows running down the vertical axis of panel 100 and also by four inputs--1200, 1220, 1240 and 1260--driving pixels in columns across the horizontal axis of panel 100. Thus, on a 640 by 240 pixel display such as LCD panel 100, input 1100 is responsible for the first 120 rows of pixels and input 1150 is responsible for the last 120 rows of pixels. For LCD panel 100, input 1200 drives the first 160 columns of pixels, input 1220 the second 160 columns of pixels, input 1240 the third 160 columns of pixels and input 1260 the last 160 columns of pixels of LCD panel 100. LCD panel 100 may be used on a notebook computer, a personal digital assistant (PDA), cellular phone or for use in any information device capable of utilizing an LCD output.

The output of such LCD panels are typically driven by "segment" drivers driving the pixel columns on the horizontal axis and by "common" drivers which enable pixel rows on the vertical axis of the panel. The physics of driving pixel output on display panels is well-known in the art and will not be described in depth. Common driver 110 and common driver 115 generate input signal 1100 and input signal 1150, respectively, while segment driver 120, segment driver 122, segment driver 124 and segment driver 126 generate input signals 1200, 1220, 1240 and 1260, respectively. Each of these segment drivers convert

serial data into parallel data and generate for output level translator signals which map an incoming digital signal into certain voltage levels which the LCD panel converts into pixel intensities based on the voltage level differentials. The common drivers activate a particular row for displaying output generated by the segment drivers.

Also shown in **Figure 1** are several control signals originating from the display controller of the cellular phone, information device or computer system that utilize the display capability of LCD panel 100. Shown are a display off control (DISPOFF) signal 140, a display data (DISPDATA) signal 150, a display clock (DISPCLK) signal 160, a line latch clock (LLCLK) signal 170, and a first line marker (FLM) signal 180. Also input to the drivers are two voltage signals, VL 197 and VSS 190. These voltage signals, VL 197 and VSS 190, can be used to indicate different logic levels to the pins they supply.

DISPDATA 150 is a signal comprised of four or eight bits--0, 1, 2 and 3 or 0 through 7--which are transmitted in parallel and represent light/color intensity levels to be output on LCD panel 100 and originates from a display controller device. DISPDATA deviate 150 is output on LCD panel 100 with bit 0 in the upper left corner of the screen and bits 1, 2 and 3 output on the same row from left to right starting after bit 0. The serial to parallel conversion of DISPDATA 150 is carried out by the timing signal DISPCLK 160 which originates from a clocking mechanism. DISPCLK 160 clocks the 4 bits of DISPDATA 150 into shift registers contained in the segment drivers. Once the shift



registers in segment driver 120 are full, then another or similar  
clocking mechanism asserts the line latch clock (LLCLK) 170  
signal to common driver 110. As shown in **Figure 1**, the line  
latch clock is also connected to a latch pulse (LP) pin or input  
5 on segment drivers 120, 122, 124 and 126, such that when the  
shift registers are filled with bits of display data and the  
LLCLK signal 170 has been asserted, the bits stored in the shift  
registers are latched and transferred over input line 1200 to LCD  
panel 100. The LLCLK signal 170 which essentially loads an  
10 entire row of pixels to LCD panel 100, also clocks the common  
driver incrementing the shift register of the common driver 110  
by one such that the LCD panel can enable the next row of the  
panel for pixels driven by the segment drivers once a row has  
been completed. DISPDATA 150 transmits a four-bit signal (in  
15 parallel), corresponding to four pixels for the LCD panel, to the  
segment drivers.

Once all of the rows of pixels have been output in this  
manner, such that the display of pixels is completed for one  
image frame, a first line marker (FLM) signal 180 is again  
20 asserted, which is also clocked with the line latch clock LLCLK  
170. First line marker signal 180 propagates through all of the  
shift registers of all common and segment drivers resetting the  
shift registers to zero, such that the common driver 110 is set  
to enable the next new row of pixel data to be output by the  
25 segment drivers. Likewise, segment drivers 120, 122, 124, 126  
are also reset to receive the next set of pixel data from  
DISPDATA 150.

The DISPOFF signal 140 shown in **Figure 1**, when driven active, disables the output for all pins and thereby blanks LCD panel 100 such that no pixels are output to the panel. FLM 180 is also divided by two by a divider circuit 185 to periodically reverse the polarity of the pins where inputs 1200, 1220, 1240, 1260 and inputs 1100 and 1150 are output by the segment and common drivers. Periodically, reversing polarity is necessary because the typical LCD requires an alternating current (AC) signal such that the liquid crystal does not "plate-out" against the electrodes and turn black. Thus, the FR pin is periodically reversed and sets the internal shift registers at one, rather than zero. Other pins shown in the segment drivers 120, 122, 124 and 126 are an XCK pin, which receives the DISPCLK signal 160, the DISPOFF pin, which receives the DISPOFF signal 140, and an output pin labeled Y1-Y160, which transmits the pixels which are stored in the shift registers of the segment drivers to the LCD panel 100. Also shown in **Figure 1** are external input/output expansion pins EIO-1 and EIO-2 for each of the segment drivers 120, 122, 124 and 126.

The expansion pins EIO-1 and EIO-2 are connected together such that the EIO-1 pin of segment driver 120 loads a ground or loads a negative voltage value from EIO-1 of segment driver 120 to EIO-2 of segment driver 122, indicating that the first 160 pixels have been output by segment driver 120 and that the next 160 pixels of the row may be output by segment driver 122. This daisy-chaining is provided also for the segment drivers 122 to 124 and 124 to 126 by propagating either

ground/negative value to these segment drivers to complete the pixel row. Likewise, on common drivers 110 and 115 are pins DIO-1 and DIO-2, which are daisy-chained together such that when the first 120 rows of pixels enabled by common driver 110 are completed, common driver 115 receives the remainder of the data and completes pixel rows 121 through 240. The FR pin, or frame pulse pin, of common drivers 110 and 115 operate similarly to the FR pins of segment drivers 120, 122 124 and 126 and will not be described further. Likewise, the DISPOFF pins of the common drivers 110 and 115 operate similarly to the DISPOFF pins of segment drivers 120, 122, 124 and 126 and will not be described further. Common driver 110 has a CK pin which is driven from LLCLK signal 170 and, in a given time index, represents the number of rows which have been output to the LCD panel 100. The SHL pin of the segment drivers 120, 122, 124 and 126, as well as the SHL pin of common drivers 110 and 115 serve to indicate in which direction pixels representing the image are output to the display, whether left to right, right to left or, in the case of the common drivers, top to bottom, or bottom to top.

Further, a mode pin is provided on all of the segment drivers and the common drivers which, when input a certain logic level from VSS 190, indicates a mode in which the drivers operate. VL 197 is shown as an input level to the SHL pins of the segment drivers and by its logic level indicates what direction the image is being output in. The physics underlying the liquid crystal display is well known in the art and will not be described so as not to obscure the invention. According to

the prior art, therefore, the entire bank of segment drivers 120, 122, 124 and 126 is always powered-up and enabled for output.

There is no signal or mechanism to power separately, any of the segment drivers. Thus, when only a portion of the panel has displayable output such as when the information device functions as a telecommunications device, the power consumed by the rest of the panel and their segment drivers is wasted.

**Figure 2** illustrates an operational diagram of a split screen LCD panel according to one embodiment of the invention.

All pins of the segment and common drivers, input and control signals which toggle them as described with respect to **Figure 1** with identical reference numbers operate similarly with regard to this embodiment of the invention and will not be repeated. However, the invention provides for additional control by way of VCC pins on each of the segment drivers as well as splitting VCC into separate signals VCC1 195 and VCC2 193. Thus, a typical segment driver circuit would need to be modified as follows to provide for split panel LCD operation.

According to the embodiment shown in **Figure 2**, a single 640 by 240 resolution dot matrix LCD panel 200, which is similar to the 640 by 240 resolution LCD panel 100 of **Figure 1**, is split logically into a 160 by 240 size sub-panel 210 and a 480 by 240 size sub-panel 204. By logically splitting a single LCD panel into two sub-panels, it is possible to save power by powering down the sub-panel of LCD panel 200 which is not being used. As shown in **Figure 1**, the DISPOFF signal powers down the entire panel and does not allow powering down a sub-panel (i.e., certain

segment drivers) of the entire panel. The power savings results from certain of the segment drivers no longer being clocked and no longer consuming power. Further power savings and probably the greater proportion of power savings is gained from not having to drive or toggle the states of the pixels in sub-panel 204.

The invention provides an improved segment driver circuit with the capability of being enabled or powered independent of other segment drivers. Specifically, a VCC pin is provided to each of the modified segment drivers 120a, 122a, 124a and 126a. These VCC pins are the positive power rails to each segment driver.

As shown in **Figure 2**, sub-panel 202 has all 240 rows of pixels but occupies only 120 pixel columns. Thus, to independently operate sub-panel 202, only segment driver 120a, which drives the first 120 pixel columns (see description of similar driver 120 of **Figure 1**), needs to be controlled.

Therefore, the invention provides control of VCC2 193 coupled to the VCC pin of segment driver 120a. When VCC2 193 is enabled (on), the VCC pin on segment driver 120a will power-on the segment driver to output pixels. When VCC2 193 is disabled (switched off), the segment driver 120a is powered-down or off and cannot drive pixel output to the display panel.

Likewise, another signal VCC1 195 is coupled to the VCC pins of each segment drivers 122a, 124a and 126a, which drive pixels on the other sub-panel 204. When VCC1 195 is on, the segment drivers 122a, 124a and 126a are all powered on and enabled to drive pixel output to the panel 200 (in sub-panel

204). When VCC 195 is off, all of the segment drivers 122a, 124a and 126a are powered down and cannot drive pixels to the display panel. The three segment drivers 122a, 124a and 126a all utilize a single source for their VCC pins since, according to the  
5 embodiment, they drive the same sub-panel.

Thus, sub-panel 202 and sub-panel 204 are capable of being independently powered, and thereby selected by the use of separate signals. VCC1 195 and VCC2 193 will be on when both sub-panels must be powered. One skilled in the art will  
10 recognize that a single panel may be split into as many logical sub-panels as segment drivers will allow. In this case, panel 200 may be split into four logical sub-panels, one for each segment driver, each segment driver powered by its own VCC signal.

15 The power source VCC1 195 and VCC2 193 are controlled from some software/hardware which selects the functionality of the panel, and therefore, indicates which sub-panels are to be powered (see power control block 660 of **Figure 6**).

**Figure 3** shows the casing structure for an information  
20 device according to one embodiment of the invention. The information device is capable of functioning both as a cellular phone for telecommunications and as a PDA. The LCD panel 200, is split logically into sub-panel 204 and sub-panel 202. The information device has a top outer shell 320 and a bottom outer  
25 shell 322 as well as a top inner shell 310 and a bottom inner shell 312. Top inner shell 310 and its obverse side top outer shell 320 bounds and contains LCD panel 200 and is connected to

joint 350 about which the top information device is able to fold. Likewise bottom inner shell 312 with its obverse side bottom outer shell 322, is also able to fold about joint 350. Bottom inner shell 312 and bottom outer shell 322 may both contain input  
5 keys such as alpha-numeric and function keys with which a user can input data, make telephone calls and/or control operation of the information device. Top inner shell 310 has an open area 300 which may be open aperture or some transparent panel which closed upon LCD panel 200, makes visible the image in sub-panel 204,  
10 thus allowing monitoring of the friction for which sub-panel 202 is intended.

The information device is "closed" when bottom inner shell 312 and top inner shell 310 abut one another by folding the Information device about joint 350. When the information device  
15 is closed, the open area 300 closely abuts the area of sub-panel 204 such that the image contents (pixels) on output sub-panel 204 are visible to the user. When closed, the outer shell 320, which may or may not be transparent (excepting open area 320), covers sub-panel 202 which is contained in inner shell 312. Upon  
20 closing the information device, a switch, relay or contact disposed about or within joint 350 will operate to power down the driver(s) for sub-panel 202 while leaving the driver(s) for sub-panel 204 powered-up. This relay or contact will toggle the VCC pins of the appropriate segment drivers as discussed in **Figure 2**.  
25 Thus, when the information device is closed, sub-panel 204 is operational while sub-panel 202 is disabled thereby saving power and screen life. This still allows the user to monitor the

telecommunications function of the information device. Further, by using one physical display rather than two separate physical displays, the information device saves by reducing device complexity and cost.

5           As shown in **Figure 3**, when closed, sub-panel 204 shows a telephone number, a "BAT" indicator indicating the level of battery life in the device and a "SIG" indicator all which are still visible to the user. Underneath, the portion of LCD panel 200 covered by outer shell 320, i.e., sub-panel 202, is powered  
10 down and inoperative. Thus, the telecommunications display of the information device can be viewed on a sub-panel while the information device one display is closed and data sub-panel is powered down.

15           When the information device is in the "open" position, both sub-panels 202 and 204 are powered. In this mode, both the data function and telecommunications functions can be displayed on panel 200. Thus, all segment drivers are powered when the Information device is open. In this embodiment, the selection of individual sub-panels via software is not needed since the  
20 position of the information device makes the selection.

**Figure 4** shows a information device with two separate displays, according to one embodiment of the invention.

25           When an information device, by design has two separate displays located on different physical planes, the invention provides for powering down one display, while keeping the other active, depending on what function is being carried out on the device. Shown in **Figure 4** is a first LCD panel 100 and a second



display LCD panel 400. LCD panel 400, if it is to use the same controller signals as the LCD panel 100, must have an equal number of rows of pixels as LCD panel 100, and consequently, the same duty cycle. Without the same vertical resolution, the controller would need to refresh to the larger of the two resolutions thereby undermining bus bandwidth, memory resources and frame rates.

System software and the video controller would treat the combination of LCD panel 100, which has a 640 by 240 resolution, and LCD panel 400 with a 160 by 240 resolution, as a single logical panel of 800 by 240. Segment driver 420 which drives LCD panel 400 receives the first set of the input data bits from DISPDATA signal 150 and upon filling its shift registers, propagates a daisy-chaining command to segment driver 121. Segment driver 121 is modified from segment driver 120a of **Figure 2** in that the EIO2 pin is extended to EIO1 output pin of segment driver 420. VSS is now connected to EIO2 so that segment driver 420 receives the input stream before segment drivers of LCD panel 100.

The separate display panels 100 and 400 are controlled similar to the split-screen (sub-panel) embodiment described above for **Figure 2**. Each of the segment drivers 121, 123, 125 and 127 of panel 100 and segment driver 420 is provided with separate VCC pins. The invention also provides a power source VCC2 493 coupled to the VCC pin of segment driver 420. When VCC2 493 is on, the VCC pin on segment driver 420 will power-on the segment driver 420 to output pixels to panel 400. When VCC2 493

is off, the segment driver 420 is powered-down or off and cannot drive pixel output to panel 400.

Likewise, another power source VCC1 495 is coupled to the VCC pins of each segment drivers 121, 123, 125 and 127, which drive pixels on display panel 100. When VCC1 495 is on, the segment drivers 121, 123, 125 and 127 are all powered on and enabled to drive pixel output to the panel 100. When VCC1 495 is off, all of the segment drivers 121, 123, 125 and 127 are powered down and cannot drive pixels to the display panel. The three segment drivers 121, 123, 125 and 127 all utilize a single signal for their VCC pins since, according to the embodiment, they drive the same sub-panel.

Thus, display panels 100 and 400 are capable of being independently powered, and thus, independently selected. VCC1 495 and VCC2 493 will be on when both display panels must be powered.

**Figure 5** is a system diagram of a computer system in which a dual LCD panel display system according to one embodiment of the invention may be utilized.

**Figure 5** shows well known elements of a computer system such as a host CPU 520, a shared memory 510 and a display controller 530. In this embodiment, LCD display controller 530 drives and controls a primary graphics LCD display panel 540 and a secondary LCD panel 550. Display controller 530 provides the signals shown in **Figure 4** such as DISPDATA 150. Specifically, display data 535 of **Figure 5** corresponds to DISPDATA 150 of **Figure 4** and control clocks 537 of **Figure 5** refer to all other

controller signals, such as FLM 180 which are provided to the LCD. Primary graphics LCD display panel 540 and secondary LCD panel 550 are shown as single blocks in **Figure 5**, but include all necessary segment drivers and common drivers, as well as internal input lines and dividers, as shown in **Figure 4** to enable output to the actual LCD panels.

Shared memory 510 services both host CPU 520 and LCD display controller 530 by way of an address bus 524. Address bus 524 carries memory addresses of shared memory 510 to/from CPU 520 and display controller 530. Data bus 526 is capable of sending and receiving to either the CPU 520 or the display controller 530. Data bus 526 delivers raw data to the LCD display controller 530 from which display controller 530 can generate actual display data 535 which are pixels to be output on LCD panels 540 and 550. Control bus 528 is used to control the flow of information from shared memory 510 which is delivered over data bus 526. A bus control (handshake) line transmits request and grant pairs to arbitrate use of the address, control and data bus between CPU 520 and display controller 530.

CPU 520 is a central processing unit, such as the Intel Pentium<sup>®</sup> processor and is capable of processing information according to code delivered to it by software or hardware through data bus 526, address bus 524 and control bus 528. The structural detail and functioning of CPU 520 as well as shared memory 510, display controller 530, address bus 524, data bus 526 and control bus 528 are well known to one reasonably skilled in the art of computer systems and will not be described further.

**Figure 5** shows a key feature of the invention which is power control block 560. Power control block 560 may be composed of multiplexers, switches, and transistors and is implemented in accordance with the specifications of CPU 520 and system architecture. Power control block 560 centrally controls the selection and thus, powering of primary LCD panel 540 and secondary LCD panel 550 through the use of selector lines 562 and 564. Power control block 560 drives selector line 562 active when secondary LCD panel 550 is to be enabled for output. If both primary display panel 540 and secondary LCD panel 550 are to be enabled for output, then power control block 560 will also activate selector line 564, such that the primary graphics display panel 540 will also be enabled for output. In the case where the user or software only requests that secondary LCD panel 550 be enabled but not primary LCD panel 540, the power control block 560 will deactivate selector line 564.

The signals VCC1 495 and VCC2 493 of **Figure 4** may originate directly from selector lines 564 and 562, respectively. When selector lines 564 and 562 dictate that both panels 540 and 550 are to be enabled for output, VCC1 495 and VCC2 493 of **Figure 4** will be enabled. Likewise, when only secondary LCD panel 550 is to be enabled, selector line 564 can enable VCC2 493 and disable VCC1 495, thereby powering down the primary graphics LCD display panel 540.

CPU 520, when instructed that only the telecommunications function of the information device is to be used, will send a command to power control block 560. A

transistor-implemented switching mechanism or multiplexer will then drive selector line 562 active, while inactivating selector line 564. The switching mechanism or multiplexer(s) are capable of necessary control signals from the CPU in response to a change  
5 in function of the information device. The selector lines are independently switched on/off within the power control block allowing more control over power usage.

**Figure 6** is a system diagram of a computer system in which a dual LCD panel display system according to one embodiment  
10 of the invention may be utilized.

Where a split-screen LCD panel embodiment is desired, a system similar to that shown in **Figure 2** may be equipped so that selector lines 662 and 664 control enabling of certain segments by providing signals VCC1 195 and VCC2 193, respectively (see  
15 **Figure 1** and associated description). For instance, when both selector lines 662 and 664 set high both VCC1 195 and VCC2 193, all four segment drivers and, consequently, both sub-panels 643 and 645 will be powered. When VCC2 193 is set high (by selector line 662) and VCC1 195 is set low, only segment driver 120 and  
20 consequently, sub-panel 645 will be powered. Within power control block 660, the selector lines 662 and 664 are independently switched using transistor or multiplexors upon receiving commands from CPU 520 regarding device function.

Power control block 660 which generates the signals on  
25 selector lines 662 and 664 is coupled to host CPU 520 and consists of components similar to those shown in and described for **Figure 5**. Further, CPU 520, shared memory 510, address bus

524, data bus 526, control bus 528 and bus control handshake 529  
operate similar to their counterparts shown in and described for  
**Figure 5** and will not be repeated. LCD display controller 630 of  
Figure 6 may be slightly different from counterpart controller  
5 530 in that controller 630 has only one physical display to drive  
(as opposed to two) and thus, may not require the  
hardware/software complexity of controller 530 of **Figure 5**.

While the present invention has been particularly  
described with reference to the various figures, it should be  
10 understood that the figures are for illustration only and should  
not be taken as limiting the scope of the invention. Many  
changes and modifications may be made to the invention, by one  
having ordinary skill in the art, without departing from the  
spirit and scope of the invention.

## CLAIMS

What is claimed is:

1        ✓1.    In an information device having a CPU, display  
2    controller and a display panel, said display panel split  
3    logically into sub-panels, an apparatus comprising:  
4        a plurality of segment drivers coupled between said display  
5    panel and said display controller, said segment drivers receiving  
6    input data from said controller, said segment drivers translating  
7    said data into pixels displayable on said display panel; and  
8        a power control block coupled to said CPU and to said  
9    segment drivers to disable a first power source which powers down  
10   a first set of said segment drivers, said powering down disabling  
11   a first set of sub-panels of said display panel from outputting  
12   pixels, said power control block disabling said first power  
13   source upon receiving a command from said CPU that said first set  
14   of sub-panels are to be powered down, said information device  
15   functioning as one of a cellular communications device and a  
16   personal digital assistant, said first set of sub-panels  
17   displaying information relevant to said personal digital  
18   assistant function, further wherein said display panel includes a  
19   second set of sub-panels displaying information relevant to said  
20   cellular communications function.

21

1           2.    An apparatus according to claim 1 wherein said power  
2 control block disables a second power source which powers down a  
3 second set of said segment drivers, said powering down disabling  
4 a second set of sub-panels from outputting pixels, said power  
5 control block disabling said second power source upon receiving a  
6 command from said CPU that said second set of sub-panels are to  
7 be powered down.

1           3.    An apparatus according to claim 2 wherein said first  
2 power source and said second power source are independently  
3 switched by said power-control block to enable outputting of  
4 pixels on said first set of sub-panels and said second set of  
5 sub-panels, respectively.

1           4.    An apparatus according to claim 1 wherein said  
2 information device has a normally open latch, said power control  
3 block to disable said first power source when said latch is  
4 closed.

1           5.    In an information device having a CPU, display  
2 controller, and two display panels, an apparatus comprising:  
3           a first set of segment drivers coupled to said display  
4 controller to receive as input a first set of data, said first  
5 set of segment drivers translating said first set of data into  
6 pixels output on a first of said display panels;



7 a second set of segment drivers coupled to said display  
8 controller and said first set of segment drivers to receive a  
9 second set of data, said second set of segment drivers  
10 translating said second set of data into pixels output on a  
11 second of said display panels; and  
12 a power control block coupled to said CPU and to said first  
13 and second set of segment drivers to disable a first power source  
14 which powers down said second set of segment drivers, said  
15 powering down disabling said second display panel from outputting  
16 pixels, said information device functioning as one of a cellular  
17 communications device and a personal digital assistant, said  
18 second display panel displaying information relative to said  
19 personal digital assistant function, further wherein said first  
20 display panel displaying information relevant to said cellular  
21 communications function.

1 6. An apparatus according to claim 5 wherein said power  
2 control block disables a second power source which powers down  
3 said first set of segment drivers, said powering down disabling  
4 said first display panel.

1 7. An information device having a single display panel  
2 logically split into a first and second sub-panel, said device  
3 comprising:

4 a top shell including a top inner shell and a top outer  
5 shell, said top outer shell on the opposing side of said top  
6 inner shell, said top inner shell containing said display panel;  
7 a joint coupled to said top shell for folding said device;  
8 and  
9 a bottom shell coupled to said top shell through said joint,  
10 said bottom shell including a bottom inner shell and a bottom  
11 outer shell, said bottom outer shell on the opposing side of said  
12 bottom inner shell, said bottom shell having an open area,  
13 wherein said open area leaves visible said first sub-panel and  
14 hides said second sub-panel when said device is closed about said  
15 joint, wherein when said device is closed, a first power signal  
16 is disabled to power down said second sub-panel and a second  
17 power signal is enabled to power said first sub-panel, said  
18 information device functioning as one of a cellular  
19 communications device and a personal digital assistant, said  
20 second sub-panel displaying information relevant to said personal  
21 digital assistant function, and said first sub-panel displaying  
22 information relevant to said cellular communications function.

1 8. An information device according to claim 7 wherein when  
2 said device is open, said first signal is enabled to power said  
3 second sub-panel and said second power signal is enabled to power  
4 said first sub-panel.

1           9.    An information device according to claim 7 wherein said  
2 information device is capable of performing a certain function  
3 when closed about said joint, said function monitored through  
4 said open area.

1        / 10. An information device having a two separate display  
2 panels, each display panel on separate physical planes, said  
3 device comprising:

4           a top shell including a top inner shell and a top outer  
5 shell, said top outer shell on the opposing side of said top  
6 inner shell, said top inner shell containing both said display  
7 panels;

8           a joint coupled to said top shell for folding said device;  
9 and

10          a bottom shell coupled to said top shell through said joint  
11 including a bottom inner shell and a bottom outer shell, said  
12 bottom outer shell on the opposing side of said bottom inner  
13 shell, said bottom shell having an open area, wherein said open  
14 area leaves visible said first display panel and hides said  
15 second display panel when said device is closed about said joint,  
16 wherein when said device is closed, a first power signal is  
17 disabled to power down said second display panel and a second  
18 power signal is enabled to power said first display panel, said  
19 information device functioning as one of a cellular  
20 communications device and a personal digital assistant, said  
21 second display panel displaying information relevant to said

22 personal digital assistant function, and said first display panel  
23 displaying information relevant to said cellular communications  
24 function.

25

1 11. An information device according to claim 10 wherein  
2 when said device is open, said first power signal is enabled to  
3 power said second display panel and said second power signal is  
4 enabled to power said first display panel

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### ABSTRACT OF THE INVENTION

An apparatus for conserving power in information devices with dual functions. A single display panel is logically split into two sub-panels. Each sub-panel can be powered up or down separately as is required by the function of the device. The display panel has a plurality of improved segment drivers which are provided power signals enabling the set of segment drivers corresponding to a sub-panel to be separately powered. In systems with two separate display panels, each of the panels may be powered up or down by the use of similar improved segment drivers as necessary.

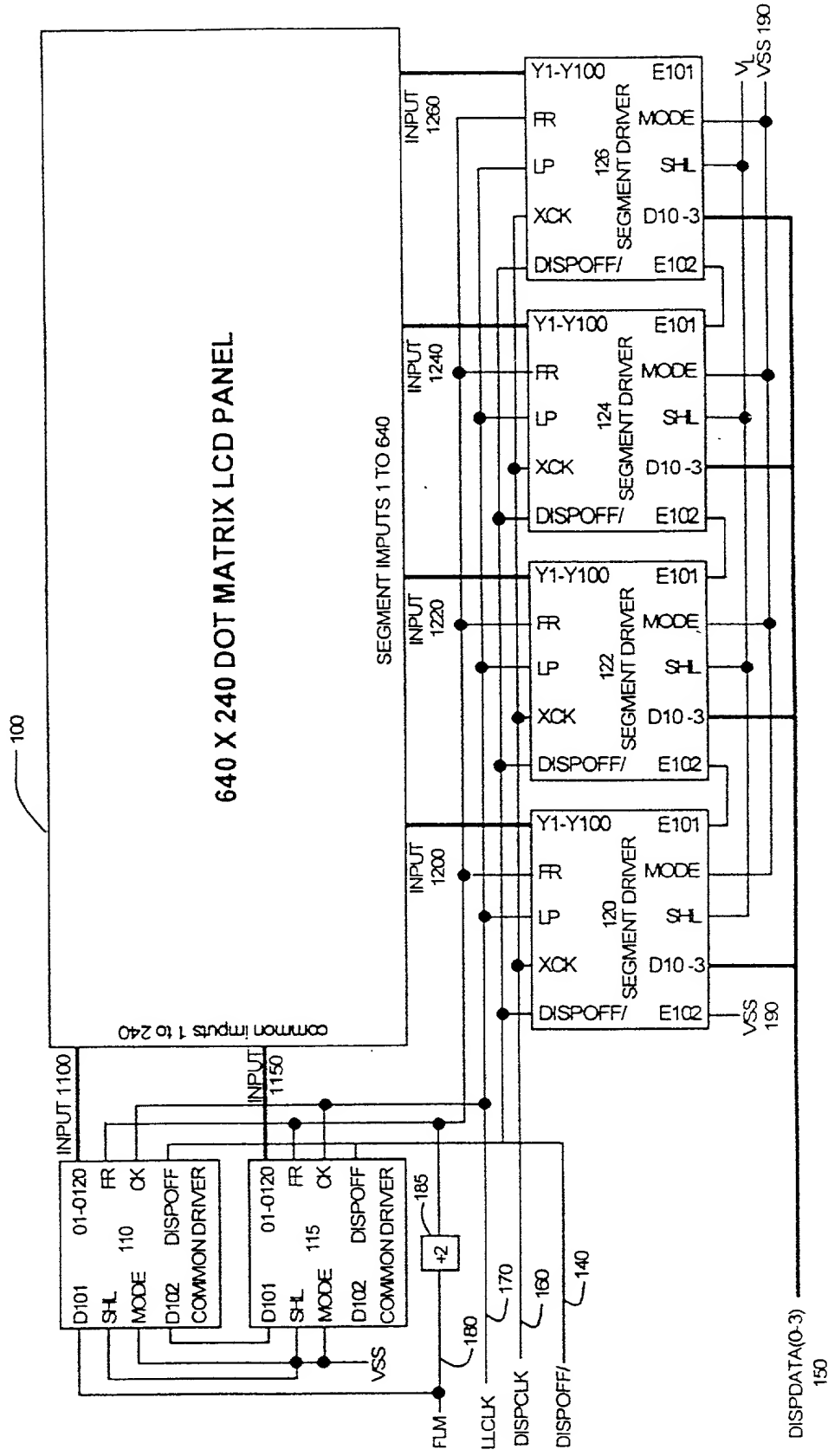
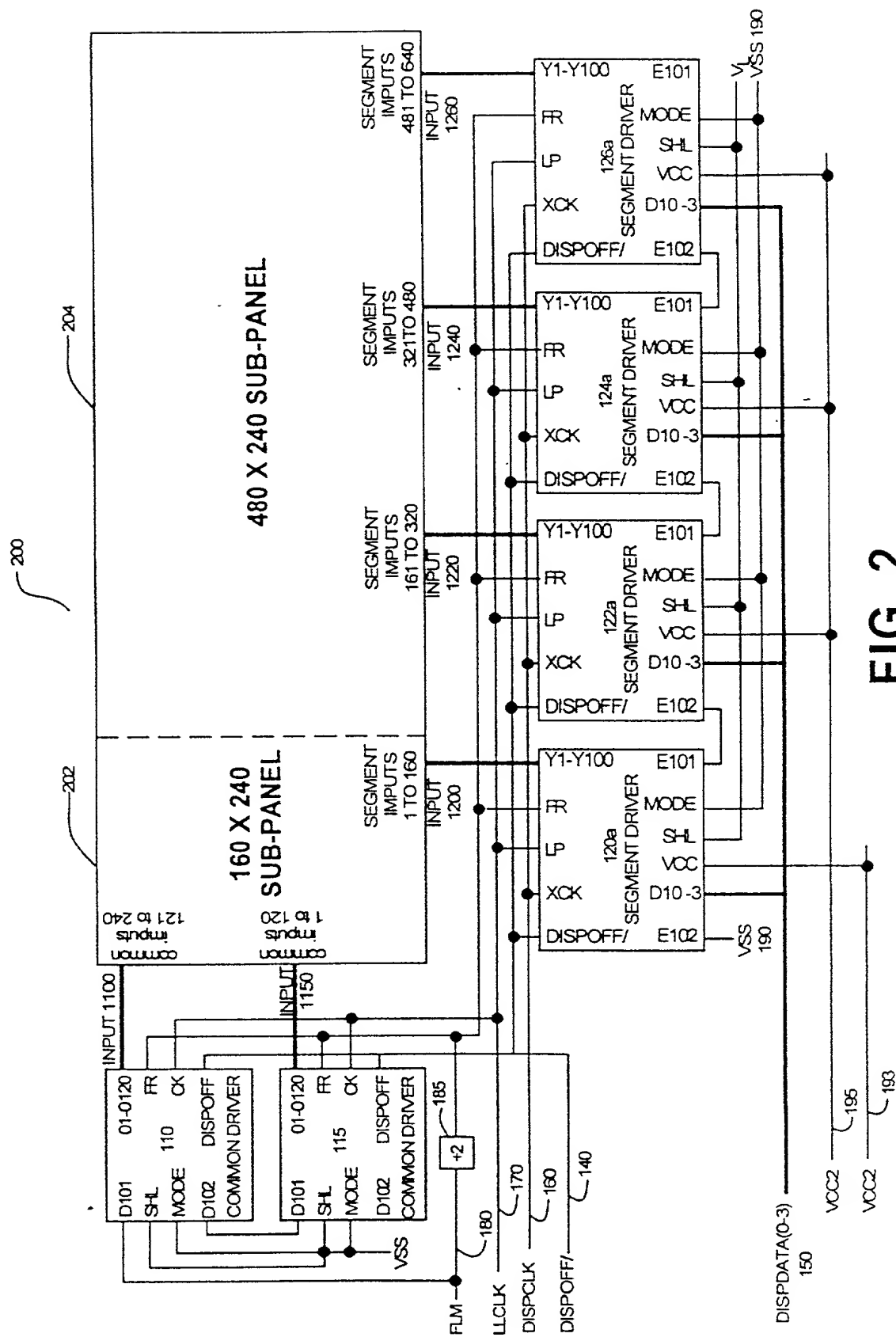
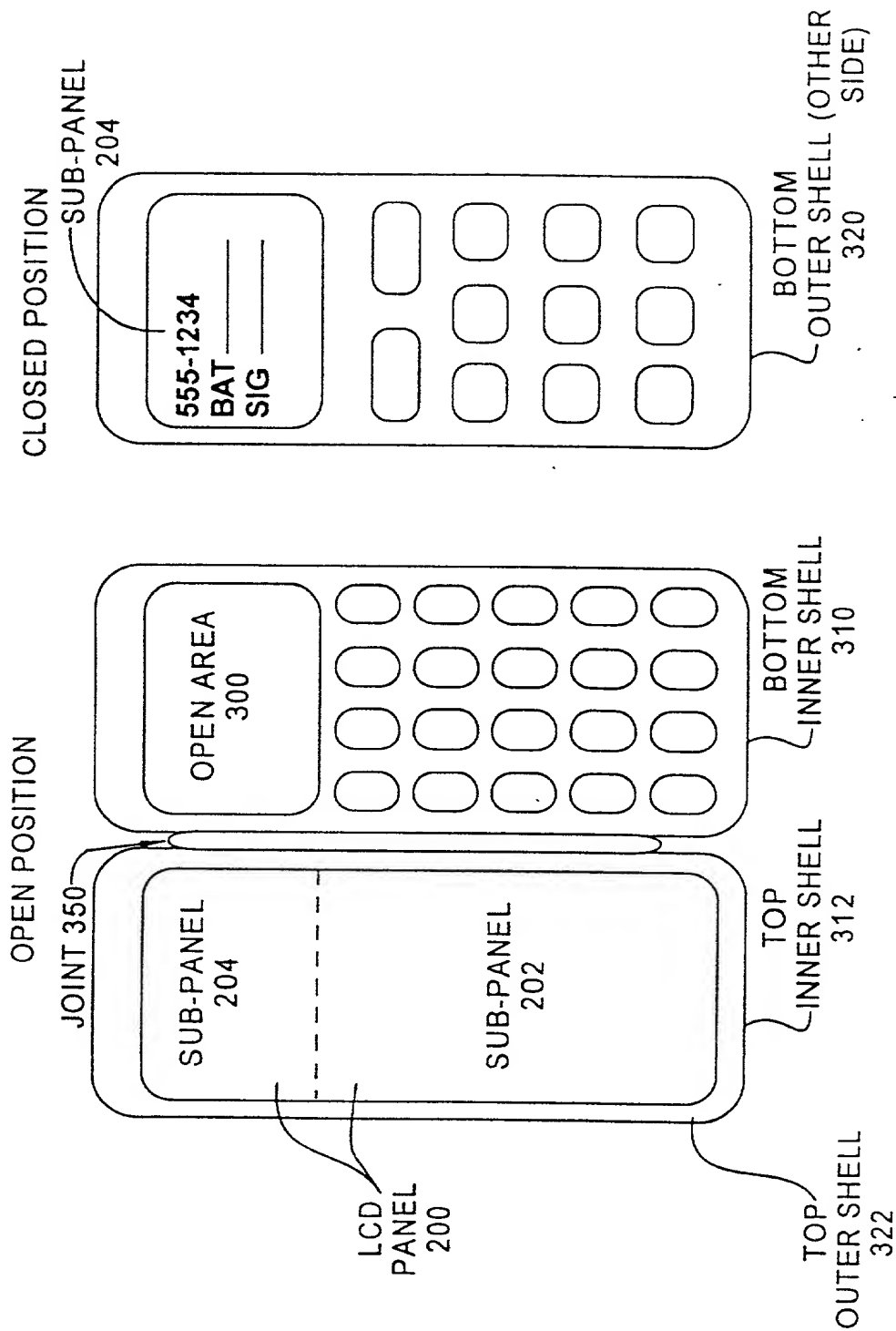


FIG. 1 (PRIOR ART)





**FIG. 3**



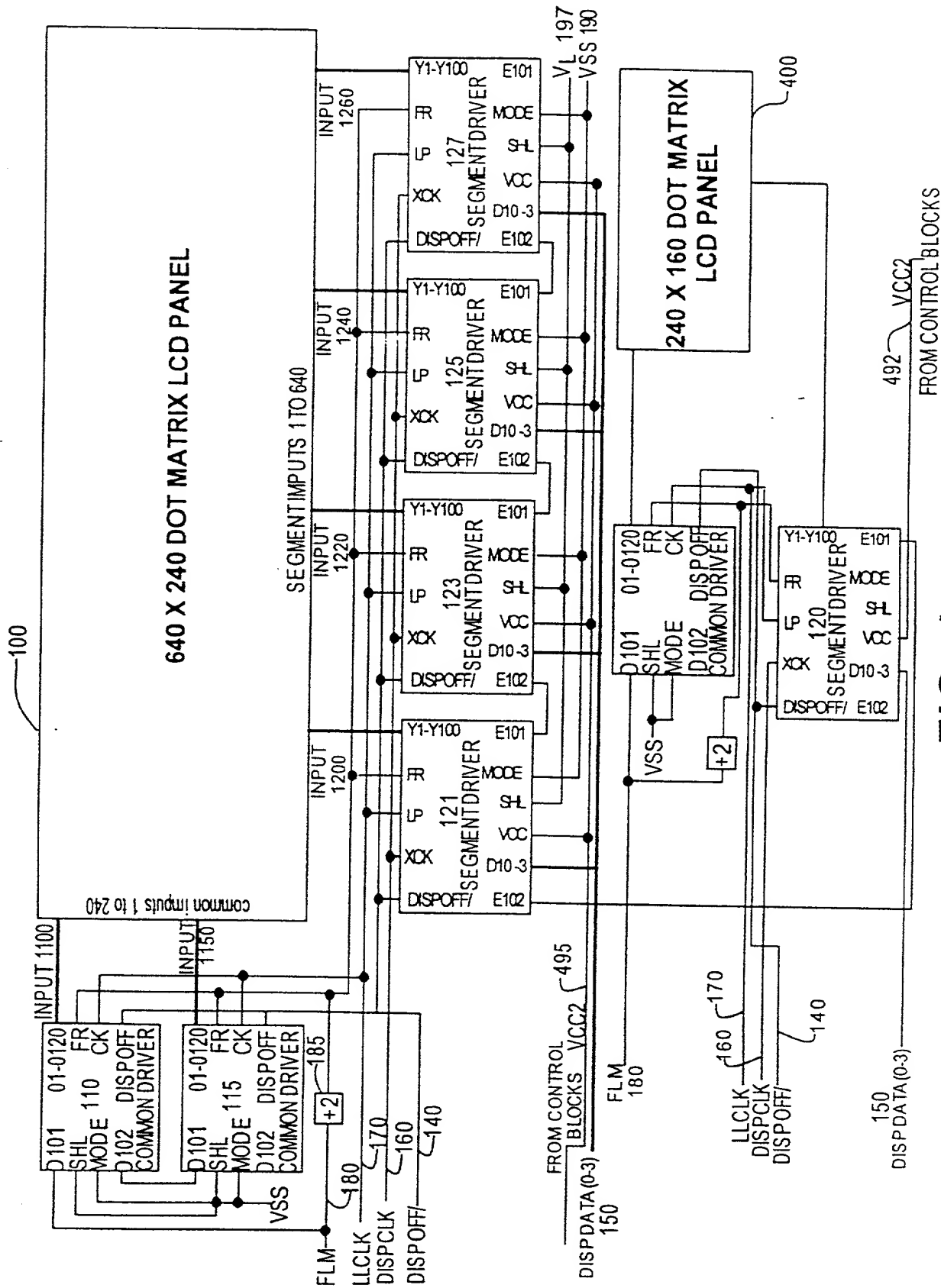


FIG. 4

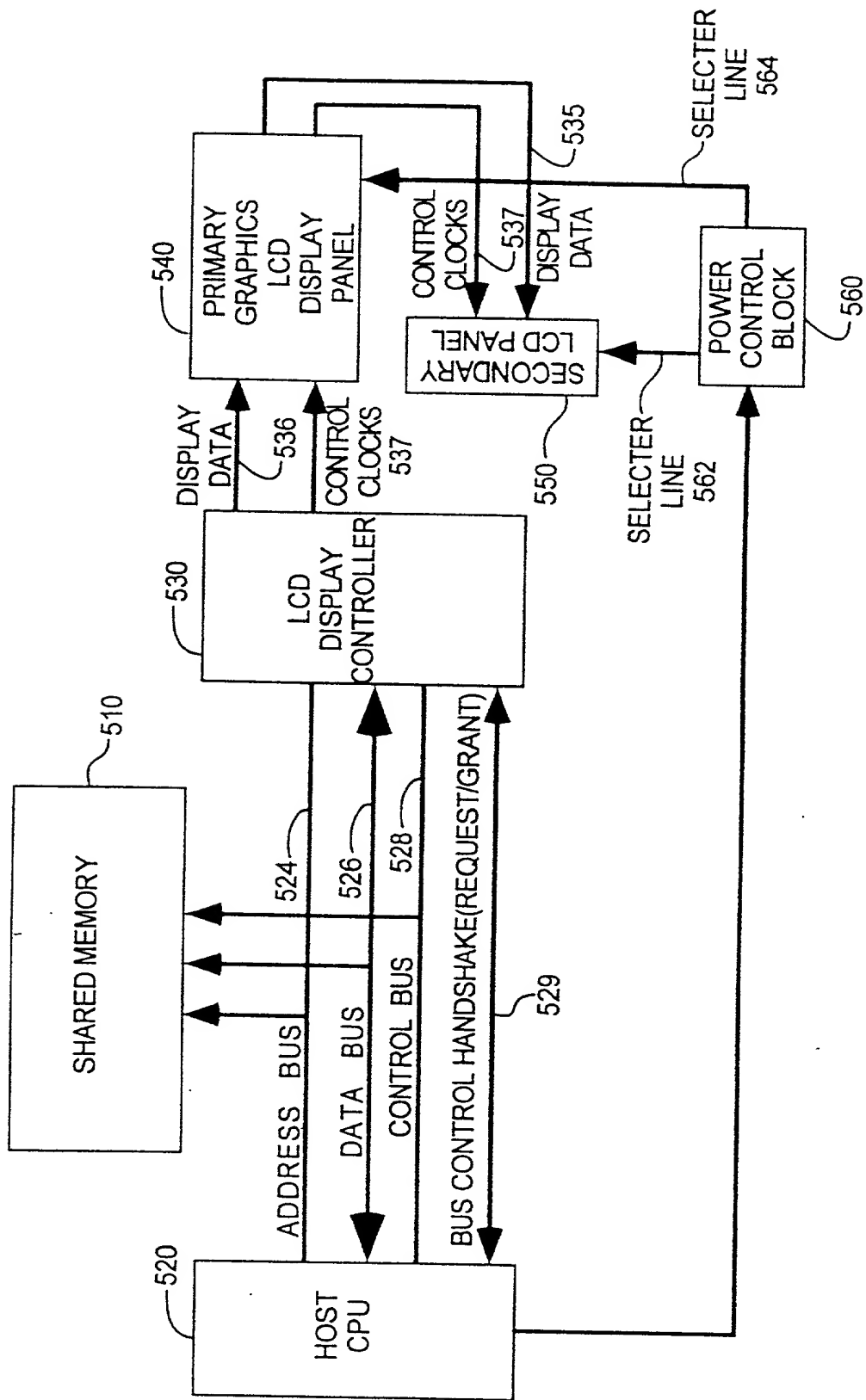


FIG. 5

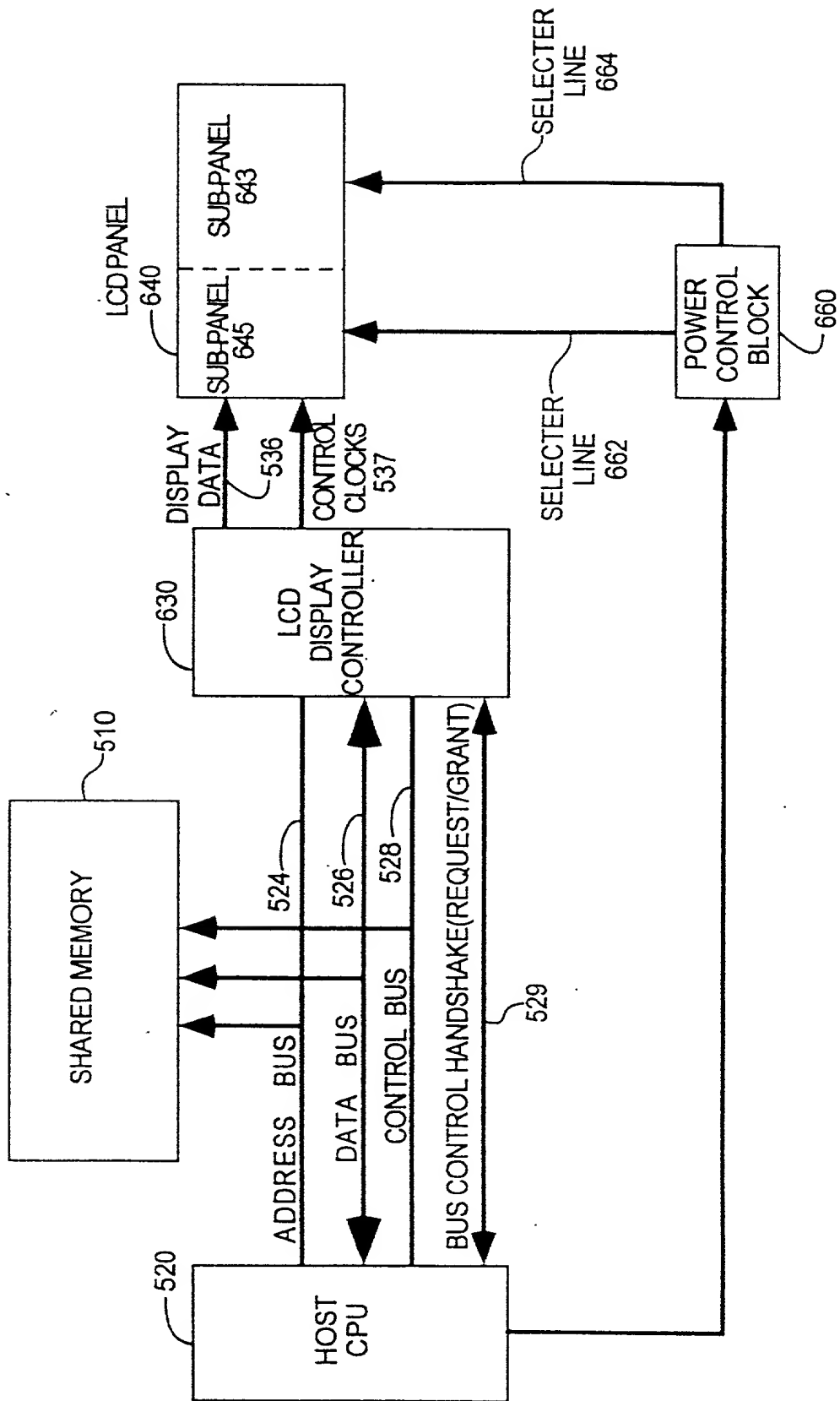


FIG. 6

DECLARATION AND POWER OF ATTORNEY FOR REISSUE PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**APPLICATION OF SPLIT -AND DUAL-SCREEN LCD PANEL DESIGNS IN CELLULAR PHONES**

the specification of which is attached hereto and was issued as U.S. Patent No. 5,841,431 (the "original patent") from application number 08/749,186 filed November 15, 1996 (the "original application").

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to the original application, that the same was not in public use or on sale in the United States of America more than one year prior to the original application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of the original application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to the original application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

<u>Prior Foreign Application(s)</u>			<u>Priority Claimed</u>	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States

provisional application(s) listed below

(Application Number)	Filing Date

(Application Number)	Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

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## APPENDIX A

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I verily believe the original patent to be wholly or partially inoperative:

by reason that the patent claims less than I had a right to claim in the patent. The claim or claims will be partly inoperative in failing to protect against infringement of all embodiments of my invention. Thus, I hereby indicate a desire to seek broadened claims as indicated in the Preliminary Amendment filed herewith. I also hereby affirm that this reissue application was filed diligently upon discovery of the following errors

The errors arose in the prosecution of the original application which resulted in the issuance of the patent. The attorney prosecuting the original application failed to appreciate the scope of the invention, and thus, limited the claims as indicated below.

The error arose without any deceptive intention on my part.

I further acknowledge my duty to disclose information which is material to the examination of the application under 37 CFR § 1.56.

Specifically, in claim 1, the phrases "plurality of segment drivers" (column 9, line 7), is unnecessary.

Full Name of Sole/First Inventor Charles R. Simmers

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

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Title 37, Code of Federal Regulations, Section 1.56  
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.